

ENERGY ENGINEERING ANALYSIS PROGRAM
FORT HAMILTON, NEW YORK

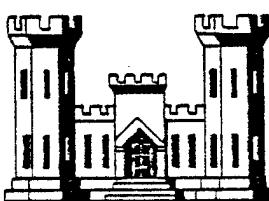
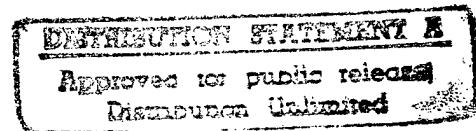
EXECUTIVE SUMMARY

FINAL REPORT

DECEMBER 1981

PREPARED UNDER
CONTRACT NO. DACA 31-78-C-0173
WITH

THE CORPS OF ENGINEERS
BALTIMORE DISTRICT



Prepared by

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DEPARTMENT OF THE ARMY

CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS

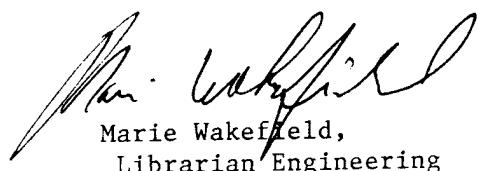
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CHAPTER 1.0

EXECUTIVE SUMMARY

1.1 INTRODUCTION

This is the Final Report on Increments A, B, and G of the Basewide Energy Engineering Analysis of Fort Hamilton, N.Y. Five complete Forms 1391, "Military Construction Project Data," and Program Development Brochures are submitted herewith, under the Army's Energy Conservation Investment Program (ECIP).

Increment A includes architectural and structural modifications (insulation, windows, weather stripping, caulking, and lighting). Increment B covers mechanical projects (boilers, central air-conditioners, timeclock controls, and Energy Monitor and Control Systems). Increment G covers maintenance and repair and minor construction projects. (In this report, Increment G projects include waste heat recovery, pipe and tank insulation, and an air curtain installation.)

This effort has been conducted under Modification to Contract No. DACA 31-78-C-0173, dated 23 December 1980, let by the Baltimore District, Corps of Engineers.

1.2 THE BOTTOM LINE

The total cost of the architectural, structural, and mechanical projects proposed herein is \$2,289,305. These have been prepared for submission in the Fiscal Year (FY) 1983 Military Construction Army budget.

When implemented, the modifications should lead to savings of 46,489 million Btu per year. The dollar savings in fuel costs in the Operations and Maintenance (O&M) account will be \$580,000 per year (in October 1983 dollars). The overall energy-to-cost (E/C) ratio is 20.3 and the simple payback is 3.9 years.

Eleven projects are proposed in the Maintenance and Repair and Minor Construction accounts. Total cost is estimated to be \$539,000, with anticipated annual savings of 9,604 MBtu and \$70,000.

1.3 ENERGY CONSUMPTION

Actual energy consumption at Fort Hamilton during FY 1980 was as follows:

Electricity	9,432,600 kWh	109,418 MBtu
No. 2 Fuel Oil	812,861 gal	112,741 MBtu
No. 6 Fuel Oil	322,365 gal	48,357 MBtu
Natural Gas	33,550,300 CF	<u>34,701 MBtu</u>
TOTAL		305,217 MBtu

Figure 1-1 shows this information in graphical form.

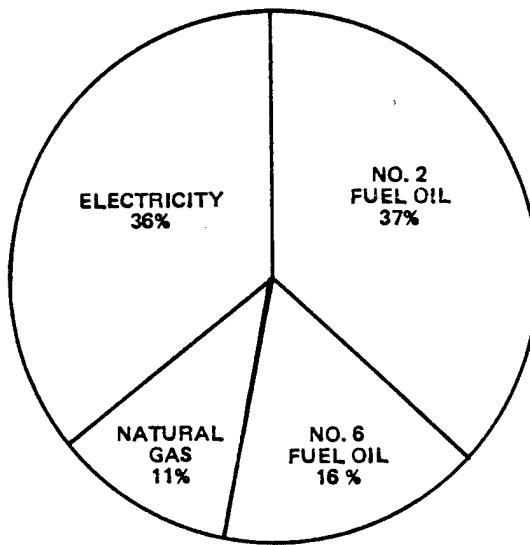


Figure 1-1. Energy Consumption at Fort Hamilton

The bill for this energy came to approximately \$2.3 million. Figure 1-2 shows the monthly consumption profiles for electricity, no. 2 and no. 6 fuel oil, and natural gas for the past 3 years.

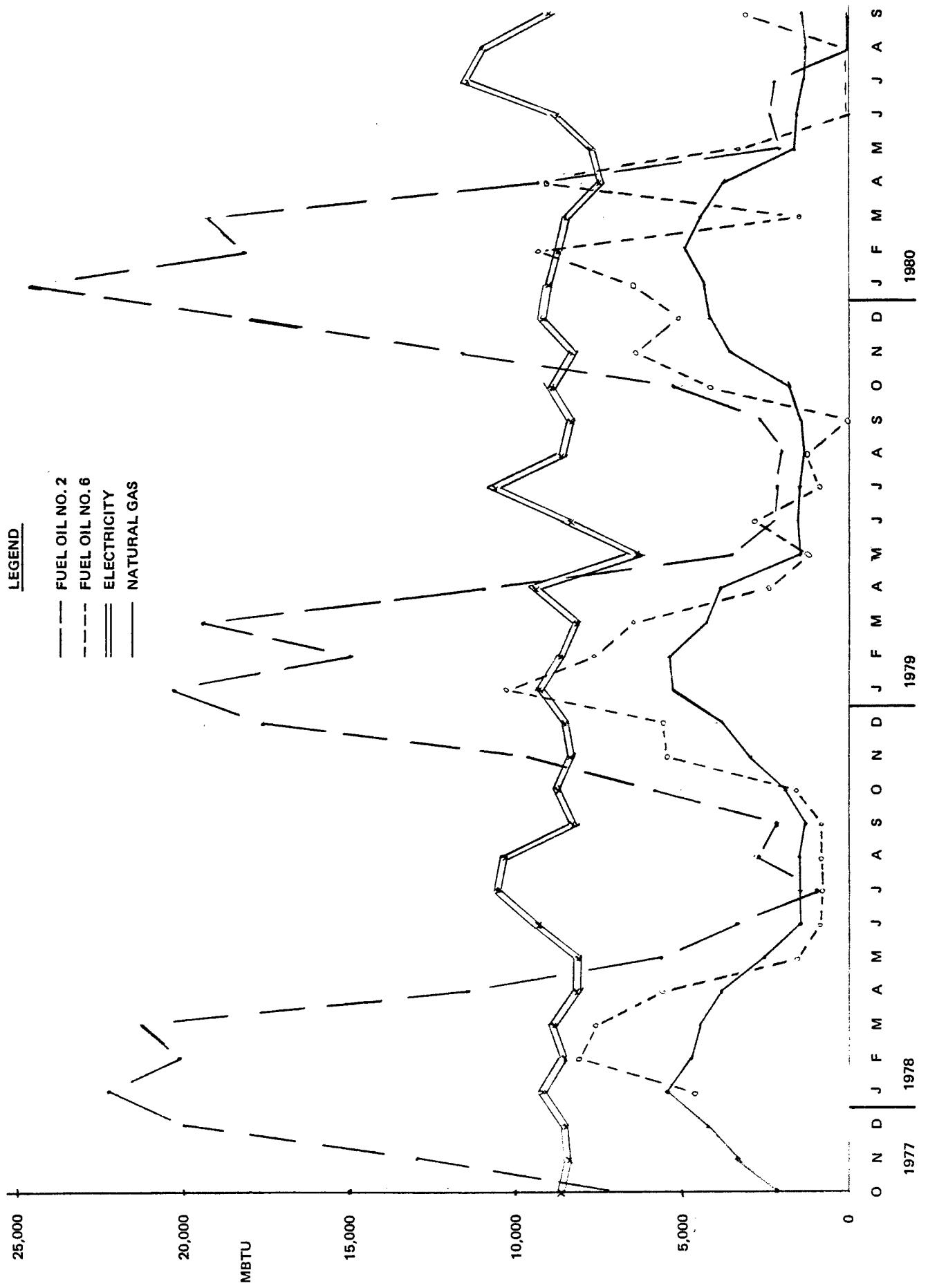


Figure 1-2. Monthly Energy Consumption, Fort Hamilton

1.4 ANTICIPATED SAVINGS

The ECIP projects proposed herein comprise the third of three events that will reduce Fort Hamilton's energy consumption and costs drastically. The first is the disposition of Dayton Manor and the second is the major rehabilitation (upgrade) of Hamilton Manor. The anticipated results are shown in figure 1-3. These actions will result in a 40 percent reduction in energy consumption at the base and, in FY 1984 dollars, a reduction in the O&M cost of energy of over 1 million dollars per year. (See table 1-1.)

Table 1-1. Annual Energy Costs

	FY 80 Consumption in FY 81 dollars	FY 80 Consumption in FY 84 dollars	FY 84 Consumption in FY 84 dollars
Electricity	876,000	1,333,000	1,156,000
Fuel Oil No. 2	932,000	1,417,000	834,000
Fuel Oil No. 6	278,000	422,000	183,000
Natural Gas	240,000	365,000	284,000
Total	2,326,000	3,537,000	2,457,000

1.5 ENERGY ENGINEERING ANALYSIS

The projects proposed herewith are the results of audits performed in the period December 1980 through March 1981 and of analyses completed in July 1981. The projects include:

- Wall Insulation
- Window Treatment (Storm Windows)
- Boiler Replacements
- Lighting Modifications (Fluorescent for Incandescent)
- Energy Monitor and Control System
- Pipe Insulation
- Weather Stripping and Caulking
- Maintenance, Repair, Minor Construction

Construction costs are estimated as of February 1981 and escalated at 12 percent per year to October 1983, the end of the program fiscal year.

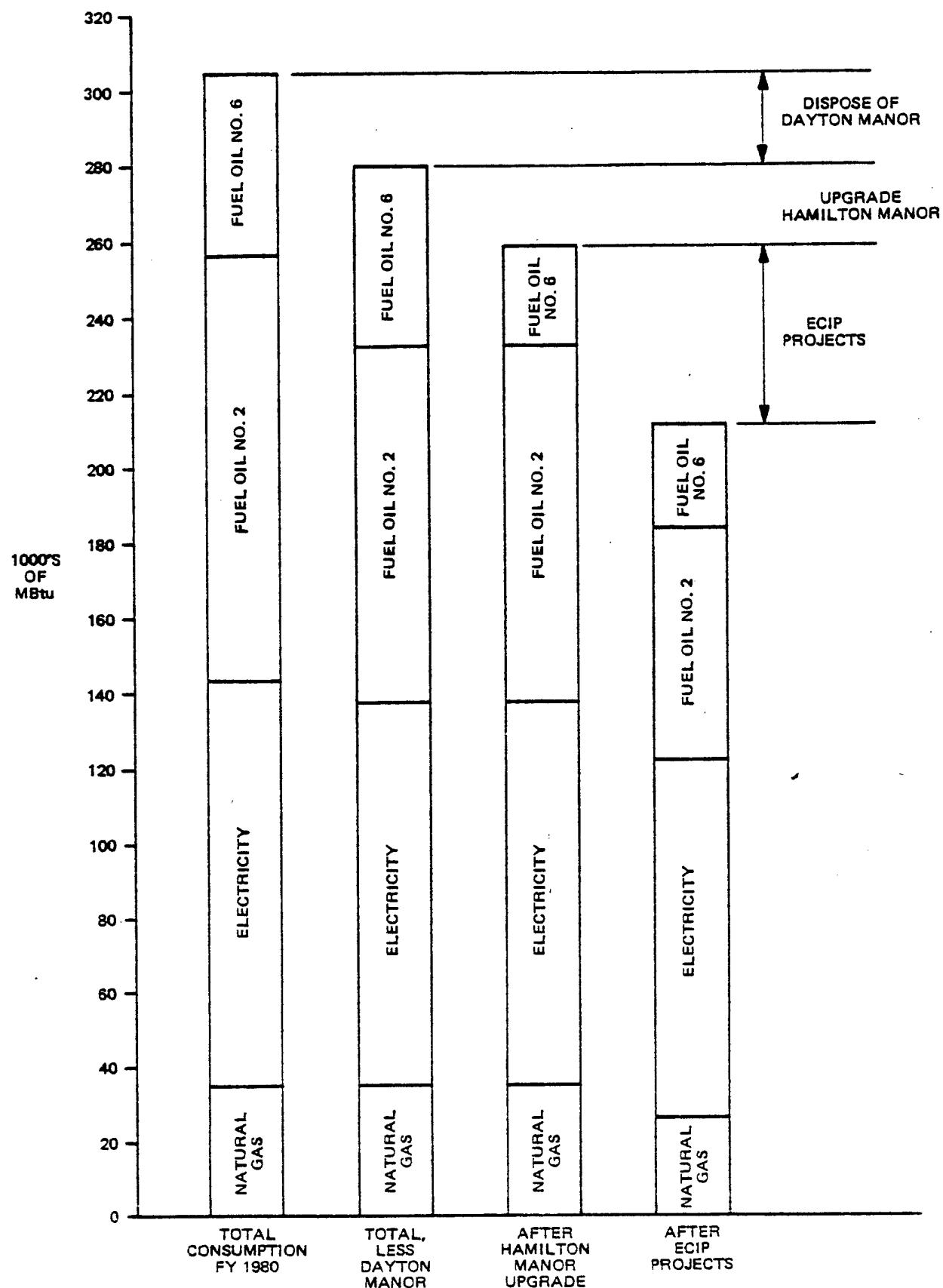


Figure 1-3. Energy Consumption at Fort Hamilton by Source

Energy costs are the actual prices in effect in February 1981. A short term escalation rate of 17 percent per year and a long term differential rate of 8 percent per year have been applied.

All procedures are in accordance with the "Army Facilities Energy Plan". All engineering calculations and computer programs are based on American Society of Heating and Air-Conditioning Engineers (ASHRAE) methods.

1.6 PROPOSED ECIP PROJECTS

Table 1-2 summarizes the conservation projects that result from this analysis.

Table 1-2. Proposed ECIP Projects

Building Group/Mod	CWE, \$	Annual Savings		E/C Ratio
		MBtu	\$	
Project 83-81: Lighting Conversion in Hamilton Manor	203,700	3,262	41,000	16.0
Project 84-81: Boiler Replacements in Family Housing	330,000	6,287	68,600	18.2
Project 85-81: General mods in Buildings other than Family Housing	467,500	11,322	148,900	24.2
Project 86-81: Boiler Replacements in Buildings other than Family Housing	517,800	11,701	149,800	22.6
Project 87-81: Energy Monitor and Control System	770,300	13,917	172,800	18.1
Increment G, Maintenance and Repair, Minor Construction (1)	538,700	9,604	70,500	17.8

(1) Increment G includes 11 projects, not all of which will necessarily be implemented.

1.7 END USE ANALYSIS

Energy consumption can be approached by source (fuel oil, electricity, natural gas), as has been done in the preceding sections, or by the purposes for which energy is expended and by the facility classes of the buildings in which it is used.

1.7.1 END USE. Energy consumption at Fort Hamilton is entirely domestic, i.e., there are no industrial or process applications.

Fuel Oil, Natural Gas

 Space Heating

 Domestic Hot Water

Electricity

 Air-Conditioning

 Lighting (indoor, outdoor)

 Domestic Appliances (refrigerators, ovens, freezers, dishwashers, fans, etc.)

 Miscellaneous (pumps, fans, office machines, and equipment)

Figure 1-4 shows the same progression of savings as in figure 1-3, broken out by end use rather than by source. It is obvious from the figure that the preponderance of savings will come from improvements in space heating, the major consumer. These savings derive from better insulation, more efficient boilers, and reduced losses through infiltration and window glass.

1.7.2 FACILITY CLASSES. The third way of presenting energy usage is to divide it by the facility classes/category codes of the several buildings involved. For the purposes of this study, the following groups have been defined:

 Dayton Manor (Family Housing)

 Hamilton Manor (Family Housing)

 Other Family Housing

 Troop Housing, Barracks and Quarters

 Administration, Operations, and Training

 Recreation, Morale, Community, and Welfare

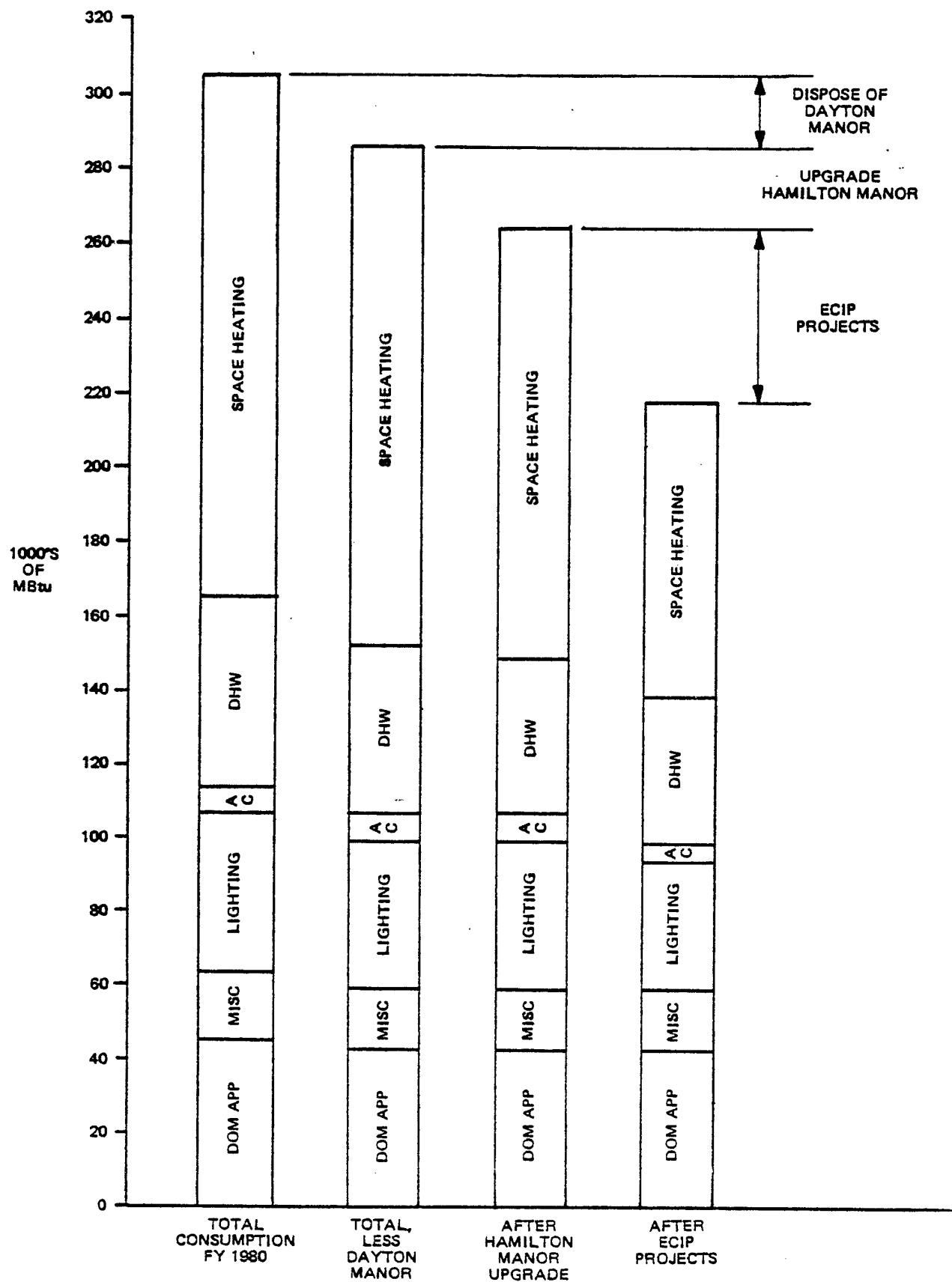


Figure 1-4. Energy Consumption by End Use

FY 1980 consumption of energy, by end use and facility class, is shown in table 1-3. The same matrix for the situation after Dayton Manor disposition, after Hamilton Manor upgrade, and after ECIP modifications is shown in table 1-4.

1.8 ECIP SAVINGS SUMMARY

The three main questions in an ECIP are "How much money do I invest?", "How much energy do I save?", and "How much money do I save?".

The total cost of the five ECIP projects in Increments A and B (as of October 1983) is \$2,289,000. Project-by-project answers to the savings questions were given in table 1-2. A matrix of savings by facility class and energy source (as of the same date) is shown below (table 1-5).

Table 1-5. ECIP Savings

	Electricity	Fuel Oil	Nat Gas	Total
Hamilton Manor MBtu \$	4,097 48,222	(835) (7,365)	- -	3,262 40,857
Other Family Housing MBtu \$	- -	2,220 29,704	4,067 38,799	6,287 68,503
Troop Housing MBtu \$	693 8,157	2,393 32,018	610 5,819	3,696 45,994
Admin, Oprns, Trng MBtu \$	2,357 27,742	18,563 248,373	2,294 21,885	23,214 298,000
Rec, Mor, Welf, Comm MBtu \$	1,637 19,267	6,897 92,282	1,496 14,272	10,030 125,821
Total MBtu \$	8,784 103,388	29,238 395,012	8,467 80,775	46,489 579,175

Table 1-3. FY 1980 Baseline by Building Category (MBtu)

END USE	DAYTON MANOR	HAMILTON MANOR	OTHER F. H.	THBQ	AOT	RMCW	TOTAL
SPACE HEATING	9,596	32,074	23,645	12,724	44,717	19,780	142,536
DOMESTIC HOT WATER	3,293	15,797	8,279	9,812	3,306	8,958	49,445
LIGHTING	3,407	9,373	3,039	6,055	12,523	8,944	43,341
DOMESTIC APPLIANCES	2,335	10,110	5,526	232	9,981	17,220	45,404
AIR-CONDITIONING	0	0	NEGLIG.	913	3,809	3,214	7,936
MISC ELECTRICITY	512	3,825	1,237	2,242	5,110	3,629	16,555
TOTAL	19,143	71,179	41,726	31,978	79,446	61,745	305,217

Table 1-4. End Use by Building Category, After Disposition, Upgrade, and ECIP (MBtu)

	HAMILTON MANOR	OTHER FH	THBQ	AOT	RMCW	TOTAL
SPACE HEATING	16,533	17,358	9,853	23,905	11,509	79,158
DOMESTIC HOT WATER	10,235	8,279	9,680	3,261	8,836	40,291
LIGHTING	5,276	3,039	5,386	12,314	8,853	34,868
DOMESTIC APPLIANCES	10,110	5,526	232	9,981	17,220	43,069
AIR-CONDITIONING	0	NEGLIG	889	1,868	2,477	5,234
MISC ELECTRICITY	3,825	1,237	2,242	4,903	2,820	15,027
TOTAL	45,979	35,439	28,282	56,232	51,715	217,647

1.9 INCREMENT G

Increment G identifies maintenance, repair, and minor construction projects which will result in energy conservation. Economic analysis is based on ECIP procedures, however, DD Forms 1391 are not to be submitted. Sufficient data are included so that local work orders can be written or projects can be prepared for accomplishment by contract. The following tabulation (table 1-6) is a summary of all Increment G Projects investigated at Fort Hamilton.

Table 1-6. Increment G Projects

PROJECT/LOCATION	SAVINGS/YEAR			COST \$	E \$/C	B \$/C	PAYBACK YEARS
	MBTU	FUEL	\$				
<u>Refrigeration Heat Recovery</u>							
Bldg 124 Meat Cut Room	94.7	NatGas	896	6504	14.6	2.7	7.3
Bldg 124 Stockroom	22.1	Elect	252	2827	7.8	1.63	11.2
Bldg 124 Sales Room	2466	#2 Oil	3286	70286	35.1	6.2	2.1
Bldg 125 Troop Issue	9.2	Elect	100	2444	3.7	.77	24
Bldg 404 Library	3.5	NatGas	25	2832	1.2	.21	112
<u>Replace Pipe Insulation</u>							
<u>Steam, Cond & Hot Water Lines</u>							
Bldgs 135, 136, 137, & 138	2826.4	#6 Oil	24929	161989	17.5	3.1	6.5
<u>Replace Buried Steam/ Hot Water Pipes</u>							
Bldgs 135, 136, 137, & 138	3215	#6 Oil	28355	172970	18.6	3.3	6.1
Bldgs 124 & 125	507	#2 Oil	6790	69957	7.3	1.9	10.3
<u>Install Separate Domestic Hot Water Boilers</u>							
Bldg 313 Family Housing	35.8	#2 Oil	355	9555	3.8	.86	28
Bldg 402 Gymnasium	78.2	#2 Oil	861	15875	5.0	1.2	18.4
<u>Install Air Curtains</u>							
Bldg 106 Motor Pool	346.5	#2 Oil	4688	23459	14.8	4.1	5.0